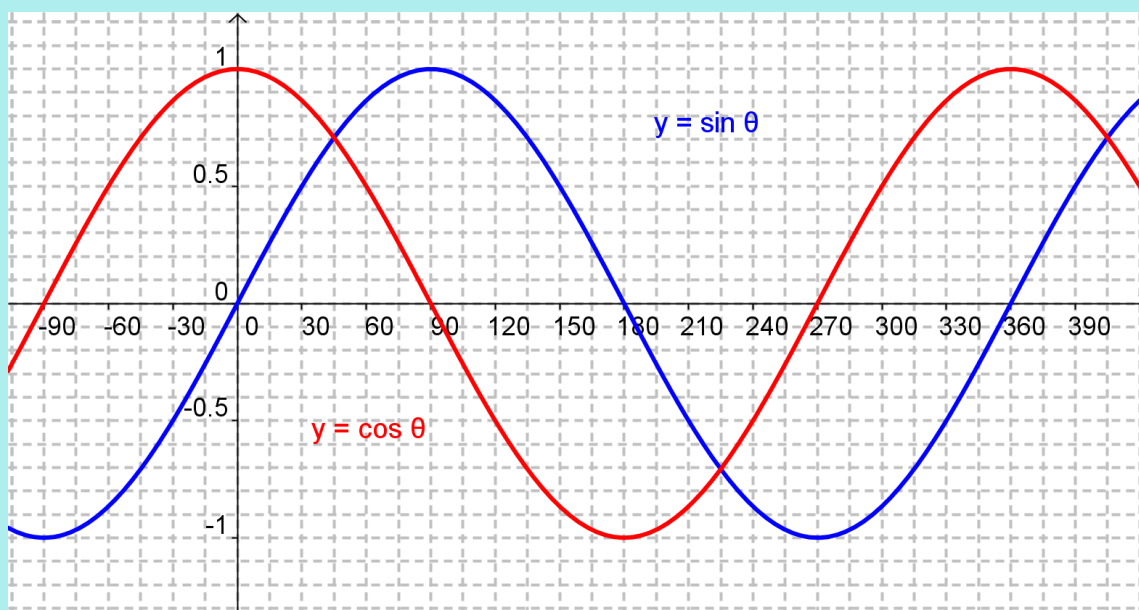


Graphing Trigonometric Functions from Key Properties

Recall: parent functions for sine and cosine



May 21-8:27 PM

Graphing Trigonometric Functions from Key Properties

Given:

$$y = a \sin [k(x - p)] + q$$

or

$$y = a \cos [k(x - p)] + q$$

- ① a gives vertical reflection and scaling
- ② k gives horizontal reflection and scaling
- ③ p gives horizontal translation or shift
- ④ q gives vertical translation or shift

$$(x, y) \xrightarrow{\textcircled{1}} (x, ay) \xrightarrow{\textcircled{2}} \left(\frac{x}{k}, ay\right) \xrightarrow{\textcircled{3}} \left(\frac{x}{k} + p, ay\right) \xrightarrow{\textcircled{4}} \left(\frac{x}{k} + p, ay + q\right)$$

May 17-9:17 AM

Graphing Trigonometric Functions from Key Properties

The standard transformations (a, k, p, q) can be expressed in terms of key properties for periodic functions and used to graph the function.

a: vertical scaling, determines the amplitude

k: horizontal scaling, determines the period

$$period = \frac{360^\circ}{k}$$

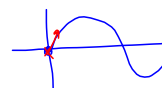
p: horizontal shift, also known as phase shift, determines the starting position of the graph

q: vertical shift, determines the axis of the curve

May 17-9:17 AM

To graph using key features:

- (1) Draw the axis of the curve (q-value)
- (2) Draw an 'envelope' for the amplitude (a-value)
- (3) Determine the period (k-value) and choose a scale that allows both the parent (if necessary) and transformed function. Divide into 4 equal sections.
- (4) Use the phase shift to determine the starting point for the graph.
- (5) Choose direction to draw (up/down and left/right) by considering any vertical or horizontal reflections.



May 23-11:32 AM

Ex.1 Determine transformations & key properties, then graph $y = -2\sin[3(x-30^\circ)]+1$

$\begin{matrix} a & k & p & q \end{matrix}$

(x,y)

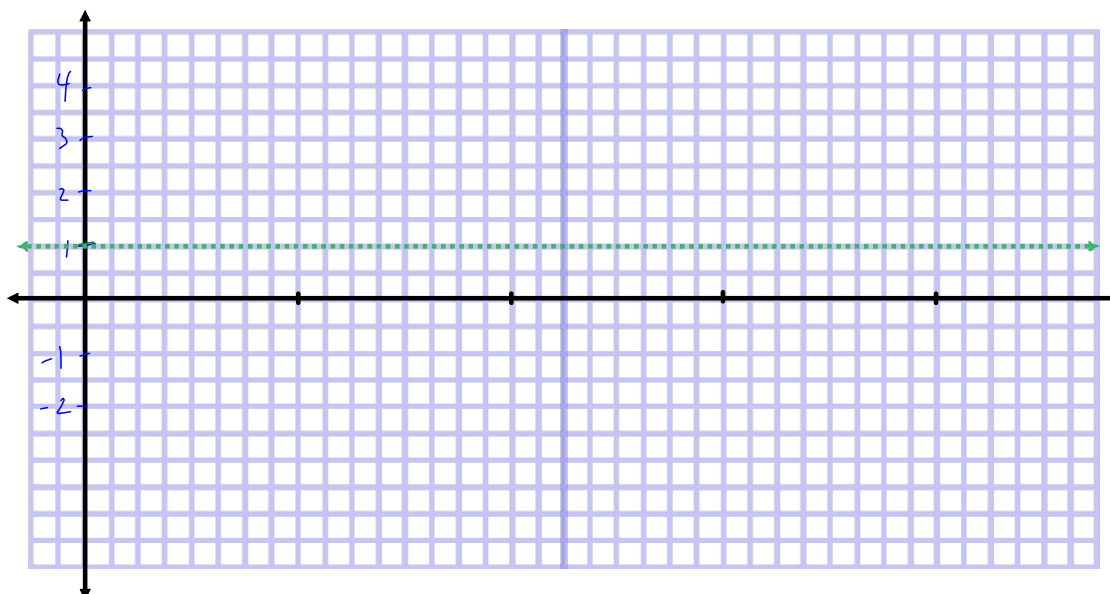
| | |
|--|---|
| <p>① v. reflection $\left. \begin{matrix} y \rightarrow -2y \end{matrix} \right\}$</p> <p>② v. stretch by 2</p> <p>③ h. compress by 3 $x \rightarrow \frac{x}{3}$</p> <p>④ h. right by 30° $x \rightarrow x+30^\circ$</p> <p>⑤ v. up by 1 $y \rightarrow y+1$</p> <p>$(x,y) \rightarrow \left(\frac{x}{3}+30^\circ, -2y+1\right)$</p> | <p>① AoC: $y = 1$</p> <p>② amp = 2 $y = 3$ "envelope" and $y = -1$</p> <p>③ period = $T = \frac{360^\circ}{3} = 120^\circ$</p> <p>④ phase shift right 30°</p> <p>⑤ on AoC ($\sin x$) down to right <u> </u> ↑ v. reflect.</p> |
|--|---|

May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2\sin[3(x-30^\circ)]+1$$

(1) draw axis of the curve

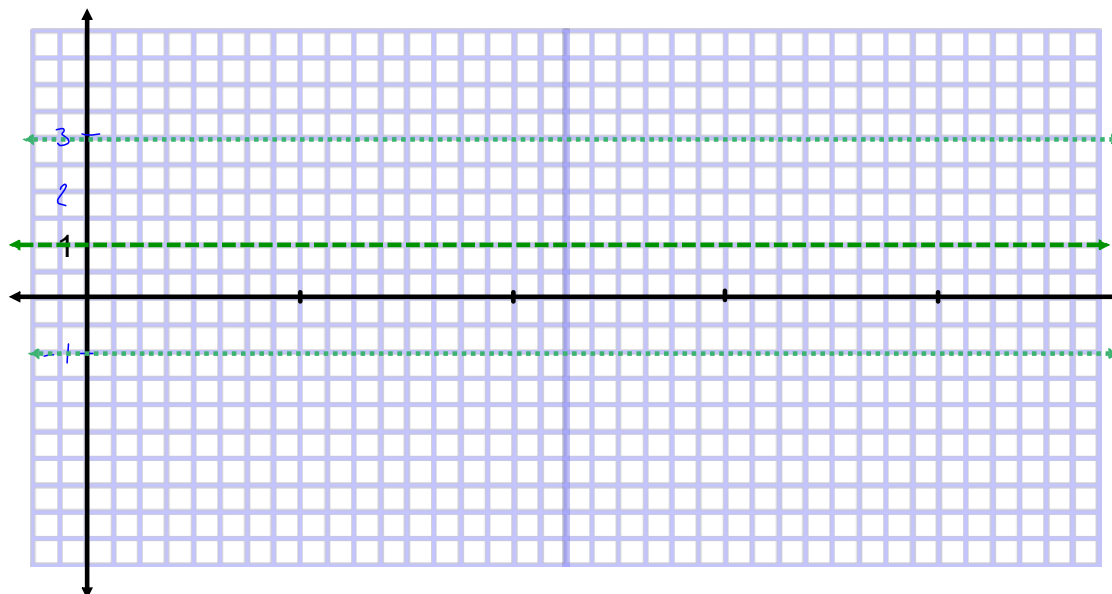


May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2 \sin[3(x - 30^\circ)] + 1$$

(2) envelope for amplitude



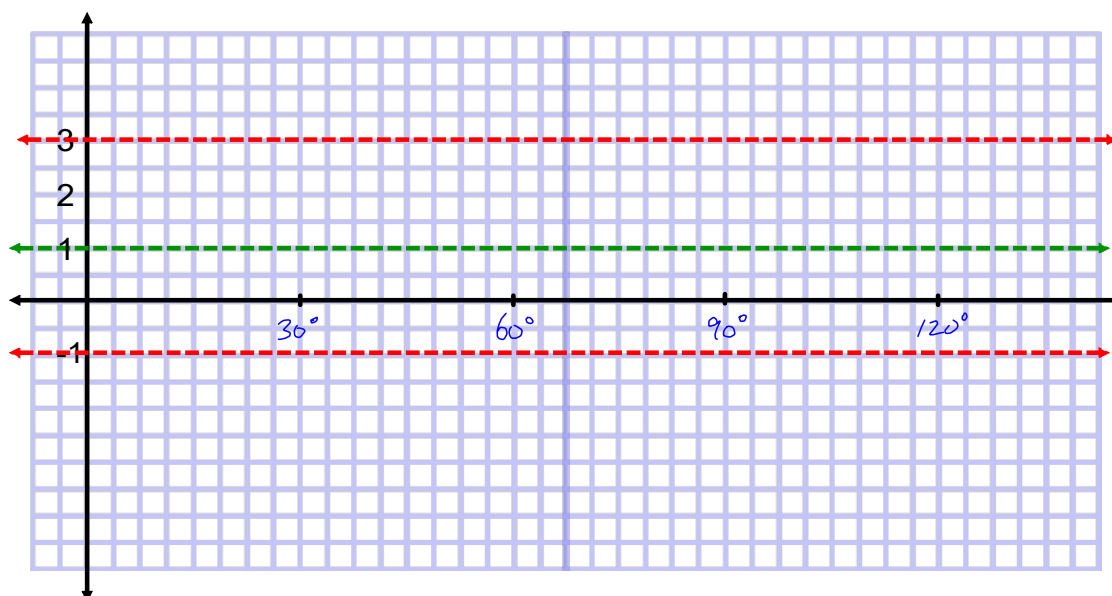
May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2 \sin[3(x - 30^\circ)] + 1$$

$$T = \frac{360^\circ}{3} = 120^\circ$$

(3) period and scale



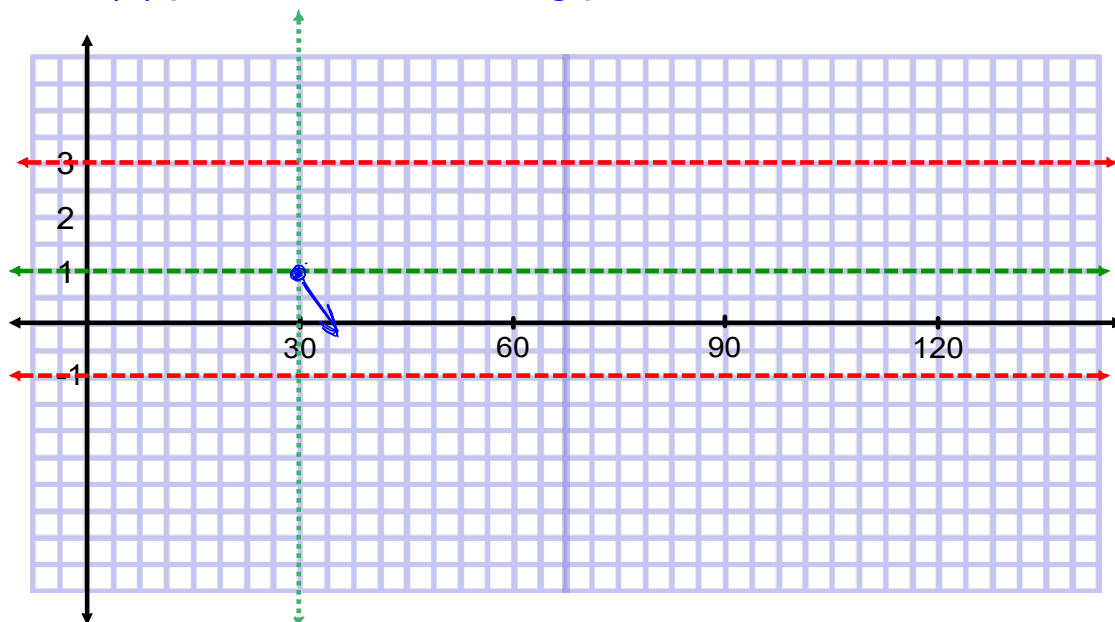
May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2 \sin[3(x - 30^\circ)] + 1$$

phase shift right 30°

(4) phase shift to starting point

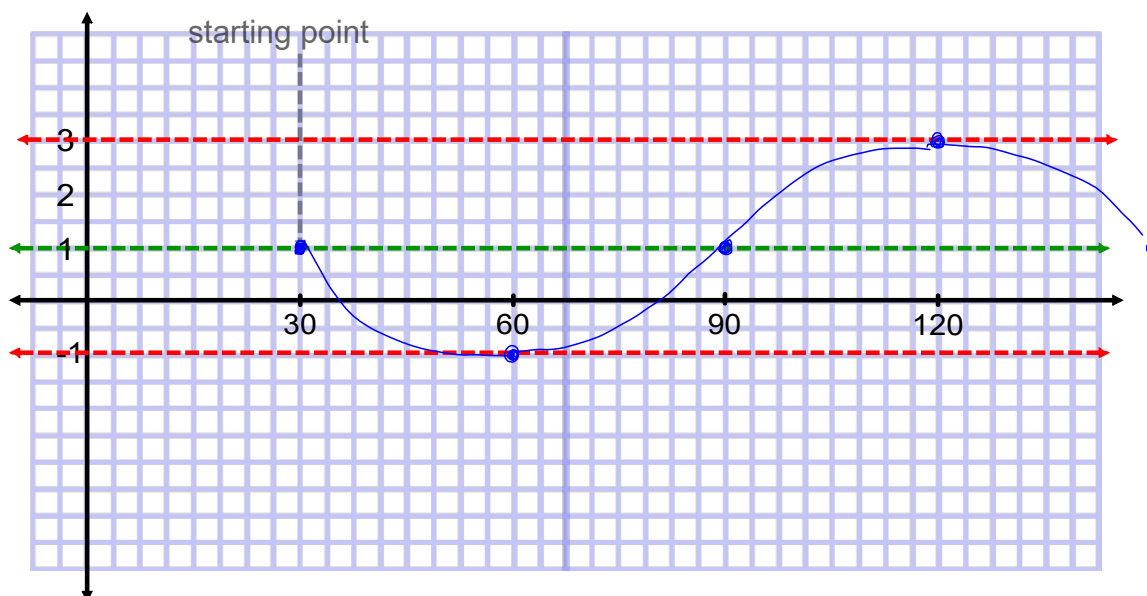


May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2 \sin[3(x - 30^\circ)] + 1$$

(5) draw curve, incorporating reflections

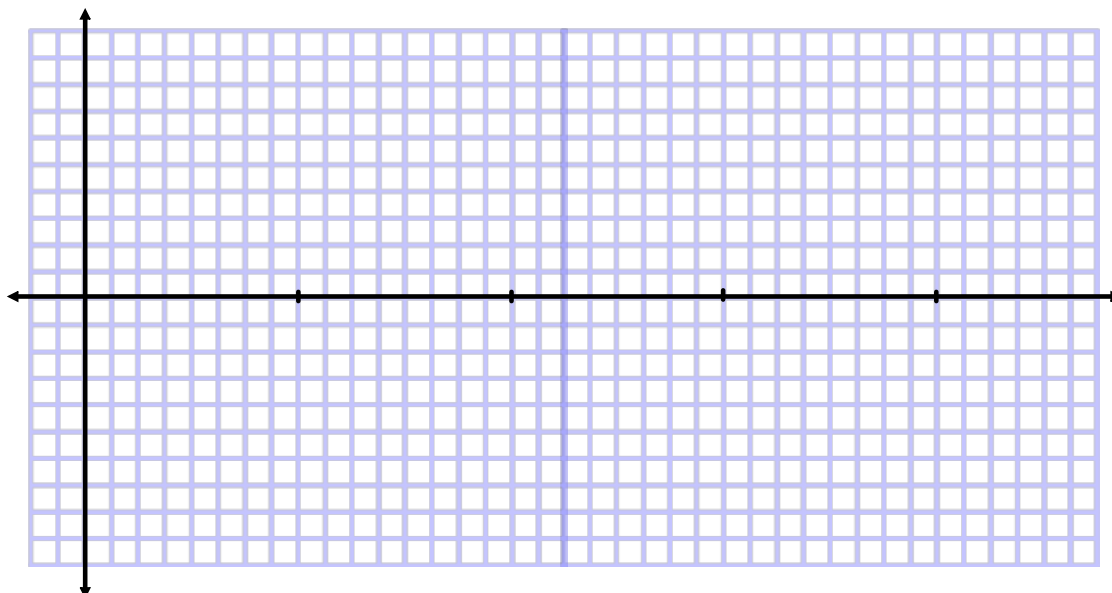


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p.374 # 2ace, 12bc

p.387 # 2abdeg, 3bd, 5abc, 6ab, 10ab

May 22-8:28 AM



May 16-9:08 AM